Journal of Traditional Chinese Medicine 9(1): 75-78, 1989.

STUDIES ON YIN-DEFICIENCY

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Yin-deficiency syndrome, like Yang-deficiency syndrome, is one of the most common syndromes in traditional Chinese medicine (TCM). Many studies have been made on its nature and treatment during recent years in China. This chapter reviews both clinical and experimental researches on Yin-deficiency syndrome and some relevant Chinese medicinal herbs.

DIAGNOSTIC CRITERIA OF YIN-DEFICIENCY

Various diagnostic criteria of Yin-deficiency in different parts of China brought difficulties in the reproducibility and comparability of different researches. In November 1982, a unified set of diagnostic criteria was passed in Guangzhou. It included three major and four minor manifestations. The major manifestations were: (1) feverish sensation in the five centres (plams, soles and heart); (2) dry throat; (3) reddened and furless tongue. The minor manifestations were: (1) afternoon flushing in the cheekbone region; (2) constipation and scanty reddish urine; (3) night sweating; (4) rapid thready pulse. The diagnosis could be established with the combination of two major and one minor manifestations.

In 1986 the above criteria were revised in Zhengzhou[1] with major manifestations of (1) feverish sensation in the five centres; (2) dry throat; (3) reddend and furless tongue; (4) rapid thready pulse, and minor manifestations of (1) afternoon flushing; (2) constipation and scanty reddish urine; (3) night sweating. Three major and one minor manifestations are essential for the diagnosis.

ANIMAL MODELS OF YIN-DEFICIENCY

Since the nature of the traditional Chinese medicine syndrome is not yet clear, animal models that represent this syndrome are still in the exploratory stage. Patients of hyperthyroidism are often differentiated as Yin-deficiency. Therefore, administration of desiccated thyroid tablets or injection of thyroxine or triiodothyronine in rats or mice is the popular method to make Yin-deficient animal models. After six days of triiodothyronine injection, the mice began to lose weight, with lowering of pain threshold and increased synthesis of deoxyribonucleic acid in the liver. On the 8th to 10th days, fatigue, inactivity, decrease in liver synthesis of deoxyribonucleic acid and liver glycogen level were often seen.[2] The animals could also have low fever, constipation, increased water and food intake, increased activity and so on. This was exactly a hyperthyroidism model. In the ear microcirculation of the animals, it was found that the speed of reticulo-capillary circulation was quickened and the opening up of capillary beds increased. The same phenomena could also be observed in mesenteric microcirculation with significant difference ($P<0.01$) in comparison with the controls.

Other methods of making Yin-deficient animal models included administration of TCM Yang-tonifiers (e.g. Radix Aconiti Preparata, Cortex Cinnamoni, Rnizoma Curculiginis, Herba Epimedii, etc) in large doses. Hypertension models were induced by unilateral ligation of the renal artery in rats (8-shaped ligation); administration of large doses of hydrocortisone in a short period (1.25 mg qd/mouse x 4 days) could also cause Yin-deficiency. On the contrary, Yang-deficiency was induced if the same dose was given for longer period (e.g. more than nine days). Pathophysiologically, the former was a hypercortisolism model and the latter was a hypocortisolism one, which corresponded clinically to Yin-deficiency and Yang-deficiency respectively.

Thyroxine plus carbon tetrachloride in peanut oil are sometimes adopted in making liver-kidney Yin-deficient models. These animals showed (1) lowered immunologic indices in PHA, dinitrochlorobenzene and T-lymphocytes; (2) interstitial congestion, edema and inflammatory infiltration of viscera; (3) hyperplasia of connective tissue, pseudolobular formation and cirrhosis of the liver; (4) interstitial congestion and atrophy of some endocrine organs, such as pituitary, thyroid, adrenal glands, and gonads.

Animal models induced by thyroxine may resemble Yin-deficient syndrome in clinical manifestations, laboratory examinations and pathological findings, though in the former the morbidity is much faster than in man.

IMMUNOLOGIC CHANGES IN YIN-DEFICIENCY

Yin-deficiency patients are vulnerable to exogenous pathogenic factors due to dysfunction of cell-mediated immune system. This is reflected by their serum total complement, C_3, IgA, IgG, IgM, rossette test, lymphocyte transformation test, PHA skin test, T-cell toxicity test, peripheral blood acid α-naphtyl acetate esterase etc[3]. No convincing change in humoral immune system has ever been observed. The immune indices of most patients can be remarkably improved with the use of TCM Kidney-invigorating and Yin-nourishing herbs.[4] In animal models Yin-tonifiers were found to lengthen the life of antibody, which could suggest increased degradation of antibody in Yin-deficient patients.

VEGETATIVE NERVOUS SYSTEM IN YIN DEFICIENCY

Yin-deficiency patients usually complain of irritability, insomnia, excitedness, flushing, night sweating, and low fever. All these symptoms indicate decreased inhibition process of the cerebral cortex and hyperfunction of the sympathetic nervous system, as can be demonstrated in conditional reflex activity, adrenaline test, blood vessel capacity test, vestibule chronaxy and pain threshold, electric activity of the skin, cold pressure test, changes in heart rate and blood pressure from recumbent to standing position, finger plethysmography, etc. It was also revealed that blood MAO level and mean urine catecholamine level were higher than normal, especially in syndromes with "fire" hyperactivity. The latter decreased significantly with treatment by Yin-nourishing drugs. Clinically, Yin-deficiency patients usually show characteristics of faster and stronger reaction to stimulus and inability to suppress excitement. All these support the view that the sympathetic nervous centre and the function of sympathetic-adrenal-medulla axis are excited in Yin-deficiency patients.

ENERGY METABOLISM IN YIN-DEFICIENCY

Palpitation, feverish sensation in the five centres, and rapid pulses are found in Yin-deficiency patients, reflecting the increase in energy metabolism. It was also found that the skin electric potential of the patients was significantly higher than controls or the Yang-deficiency groups. The erythrocyte APT content and glucolytic rate in erythrocytes were greater, and returned to normal after the treatment by Kidney-nourishing medicinal herbs. The increased erythrocytic Na^+ pump activity did not return to normal until Yin-nourishing drugs were used. It is well known that Na^+ pump is related with heat production in cells. Accordingly, Na^+ pump activity of liver, kidney and small intestine mucosa in thyroxine-treated Yin-deficiency rats was also raised significantly than normal controls.[5] Creatinine, urea nitrogen and hydroxyproline were found to be excreted in a larger amount in Yin-deficiency patients, and reduced gradually after Yin-tonifying treatment.

HEMORRHEOLOGY IN YIN-DEFICIENCY

Coronary heart disease patients differentiated as Yin-deficiency are usually noted with elevated blood viscosity ratio, plasma viscosity ratio and erythrocyte electrophoresis time in comparison with the control group. The increased level may be parallel to the extent of hyperactivity of "fire" due to Yin-deficiency, and can be lowered by nourishing Yin and invigorating blood circulation.[6] Blood viscosity ratio and hematocrit may also show an elevated level in other diseases of Yin-deficiency, such as in chronic obstructive pulmonary diseases and viral hepatitis, indicating that the hemorrheologic changes of Yin-deficiency are increase in blood viscosity and hematocrit. The patients' blood appears to be more concentrated and viscous to some extent, which may explain the lack of body fluid in Yin-deficiency patients.

MICROCIRCULATION IN YIN-DEFICIENCY

Yin-deficiency patients usually show hectic fever and other manifestations due to dilatation

and congestion of the microangium. In studying the microcirculation in nail beds of Yin-deficiency patients suffering from hypertension, obstructive pulmonary diseases, tuberculosis and hepatitis, many researchers noted the congregation of blood cells, increase in capillary diameter and number of open capillary loops, which indicated disturbance of microcirculation. In Yin-deficient patients, the capillary loops and dilated microangium were found increased in fungiform papillae on the tongue tip.[7] The changes in microcirculation of the tongue tip were similar to that of the nail bed, due to the hemorrheologic changes in Yin-deficiency.

CYCLO-NUCLEOTIDE AND YIN-DEFICIENCY

Several years ago, cAMP and cGMP were considered to be the material basis of the Yin-Yang theory in TCM. Many studies have been done on the relationship between cAMP, cGMP and Yin-Yang syndromes. In Yin-deficiency patients, some researchers have reported an elevation of plasma cAMP, and the ratio of cAMP to cGMP, while others have observed the lowering of cAMP or a normal cAMP level. Until present, there has been no definite conclusion about the cAMP, cGMP changes in Yin-deficiency. This may be due to the difference between plasma cAMP and intracellular cAMP, the former can not reflect the minute changes in the latter. Therefore, plasma cAMP may not be of importance in Yin-deficiency.

HYPOTHALAMUS-PITUITARY-ADRENAL AXIS IN YIN-DEFICIENCY

The endocrine changes of deficiency syndromes have been investigated intensively in China. However, unlike in Yang-deficiency, the dysfunction of hypothalamus-pituitary-adrenal axis remains to be clarified in Yin-deficiency. One hundred and fifty-six cases studied in Shanghai Medical University suggested that the plasma leucine enkephaline level in Yang-deficiency patients was significantly lower than that in the Yin-deficiency group, whereas the plasma cortisol level was higher in the latter. Since the activity of opium-like materials is parallel to ACTH, both Yin- and Yang-deficiency may interfere with the vitality of the hypothalamus-pituitary-adrenal axis. Urine 17-OHCS level varied in patients with Yin-deficiency. It may be normal or higher or even lower than control and may be related to whether there is "fire", its severity and the viscera affected.

GONADAL FUNCTION IN YIN-DEFICIENCY

Disturbances in gonadal function such as menstrual dysfunction, nocturnal emission, impotence are commonly seen in Yin-deficiency. Vaginal smears of climacteric syndrome patients revealed rise in estrogen level. It was reported that child-bearing age women suffering from irregular menstruation or functional uterine bleeding and no ovulation could be treated by invigorating the "kidney-Yin", thus raising the ovulation rate up to 92.3%. Infertility with Yin-deficiency could as well be cured in this way. Vaginal exfoliative cells in all patients of functional uterine bleeding without ovulation were found to have an eosin index as high as 81.%. It was observed that the plasma testosterone level in Yin-deficiency was significantly lower than that in Yang-deficiency. Similar changes in the sexual cycle were also very marked in Yin-deficient animal models.

THYROID FUNCTION IN YIN-DEFICIENCY

Intolerance to heat, sweating, irritability, emaciation and rapid pulse are the common symptoms of the Yin-deficiency syndrome, somewhat similar to hyperthyroidism. The latter is thus regarded as an Yin-deficiency animal model. Symptoms of hyperthyroidism were usually relieved by nourishing Yin, and basal metabolic rate decreased significantly, while PBI, T_4 and TSH remained higher than normal. During animal experiment it was discovered that Yin-tonifiers (compound decoction of rehmannia root and tortoise plastron (生地龟板合剂) could diminish the number of β-adrenal receptors in rats with hyperthyroidism induced by T_3 injection. Thus Yin-tonifiers may help treat the excitement symptoms of sympathetic nervous system in hyperthyroidism. Values of serum TT_3, TT_4 FT_3, FT_4, rT_3, TSH detected in patients with any deficiency syndrome, whether Yang, Yin or both Qi and Yin deficiency, revealed that T_4 level usually remained normal while T_3 lowered and rT_3 raised. This suggested that the transformation from T_4 to T_3 decreased because of the increase of the bypass from T_4 to rT_3. In spite of the low level of FT_3, the negative feedback inhibition of TSH still existed due to the increase of FT_4, which was different from hypothyroidism.

OTHER ENDOCRINE GLANDS IN YIN-DEFICIENCY

In coronary heart disease, hypertension and chronic hepatitis, these patients of Yin-deficiency show low glucose tolerance, possibly due to the hyperfunction of sympathetic nervous system. Some researchers found significant increase in plasma $PGF2_{\alpha}$ in Yin-deficiency patients, which may be related to the plasma level of cyclonucleotides.[9]

PATHOLOGICAL CHANGES IN YIN-DEFICIENCY

Recent autopsy studies[10] showed that the structural basis of Yin-deficiency was the atrophy of most organs and endocrine glands, especially the adrenal gland. The atrophy of adrenal gland was parallel to the extent of Yin-deficiency and inversely so to the severity of "fire".

TRACE ELEMENTS IN YIN-DEFICIENCY

Zhongshan Hospital reported that the zinc concentration in the saliva of patients with Yin-deficiency was as high as 0.232 μg/ml, significantly higher than the normal value of 0.099 μg/ml. However the serum zinc concentration in Yin-deficiency was significantly lower than normal,[11] which may be due to more excretion or less uptake of zinc. Serum zinc concentration in most deficiency syndromes was lower than normal, whereas concentration of serum iron was high in Yin-deficiency, and that of serum copper varied. The exact relationship between trace elements and Yin-deficiency syndrome requires further study.

YIN-TONIFYING DRUGS AND PRESCRIPTIONS

According to the above studies of Yin-deficiency, Yin clinically may represent the vital essence, fluids, and other materials of the viscera or the body, so Yin-tonifiers may be used to relieve the symptoms of low fever, night sweating, thirst, dry throat, dry cough, constipation, and frequent micturition. The commonly used Yin-tonifiers are American ginseng (Radix Panacis Quinquefolii), dendrobium (Herba Dendrobii), lilyturf root (Radix Ophiopogonis), figwort root (Radix Scrophulariae), tortoise plastron (Plastrum Testudinis), turtle shell (Carapax Trionycis) etc.

The classical Yin-replenishing prescription is Rehmania Pills of Six Herbs (Liuwei Dihuang Wan), which is used to replenish vital essence of both the Kidney and the Liver in the treatment of Yin-deficiency. It is used effectively in relieving symptoms of Asthenic Fire such as dizziness, tinnitus, sore throat, tidal fever, nocturnal emisson, etc. In terms of western medicine, this recipe may be used for the treatment of diabetes mellitus, chronic prostatitis, central retinitis, hypertension, the Guillain-Barre syndrome, chronic nephritis, etc, that pertain to the symptom-complex of Yin-deficiency.

REFERENCES

1. 沈自尹等：中医虚证辨证参考标准。中西医结合杂志6（10）：598，1986。
2. 上海中医学院正常人体学教研组：阳虚、阴虚造型以及某些助阳药和滋阴药作用的初步研究。新医药学杂志（9）：417，1977。
3. 王冠庭等：虚证（气虚、阴虚）患者外周血淋巴细胞酸性脂酶的变化及其意义。中西医结合杂志4（11）：660，1984。
4. 张树一：对小儿虚证机体免疫状态的初步探讨。上海中医药杂志（2）：20，1980。
5. 陈锐群等：阴虚内热证初探。中西医结合杂志3（4）：235，1983。
6. 谭达人：冠心病阴虚和阳虚患者血液流变性再探。中医杂志23（7）：521，1982。
7. 张清波：通过外周微循环、血液流变性和免疫功能的观察，探讨病毒性肝炎的中医辨证分型。中华医学杂志62（8）：449，1982。
8. 李超荆：肾生殖与排卵机理的初步探讨。中医杂志23（6）：469，1982。
9. 宋玫等：中医虚证与血浆前列腺素含量的变化。中医杂志24（1）：75，1983。
10. 重庆医学院新医病理研究小组："八纲"之病理解剖学基础初探。新医药学杂志（3）114，1975。
11. 王冠庭等：慢性肝病虚证（肝阴虚，脾气虚）血中微量元素锌、铜的变化及其意义。中西医结合杂志2（3）：145，1982。